2003

Seasonal and Rotational Influences on Corn Nitrogen Requirements

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Abstract
This project is designed to study nitrogen (N) fertilization needs in continuous corn (C-C) and corn rotated with soybeans (C-S) as influenced by location and climate. Multiple rates of N fertilizer are spring applied, with the intent to measure yield response to N fertilization within each rotation on a yearly basis for multiple years at multiple sites across Iowa. This will help determine N requirements for each rotation practice, differences that exist between the two rotations, and responses to applied N across different soils and climatic conditions. It will also allow for the evaluation of tools used to adjust N application.

Keywords
Agronomy

Disciplines
Agricultural Science | Agriculture | Agronomy and Crop Sciences

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Introduction

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Materials and Methods

The first year of this research at the Northwest Research Farm was 2000. The study area was cropped to corn in 1999. Therefore, in the initial year all yields follow corn. The two rotations, C-C and C-S, were initiated in 2000. The soil at this location is Galva silty clay loam.

Tillage is fall chisel plowing and disk/field cultivation before planting. Rates of N applied to corn are 0–240 lb N/acre in 40 lb increments. Urea fertilizer is the N source and is broadcast and incorporated with secondary tillage before planting. No N is applied with the planter. The farm superintendent chooses the corn hybrid and soybean variety. Weeds are controlled using practices typical of the region. Soil is sampled for routine soil tests, and phosphorus, potassium, and lime are applied as called for by the soil tests.

Corn and soybeans are harvested with a plot combine. Yields are corrected to standard moisture. Corn ear leaf greenness, which is an indicator of chlorophyll and nitrogen, is measured with a Minolta SPAD meter at the R1 growth stage. The SPAD meter will not indicate excess N; therefore, readings typically do not increase above a maximum greenness even with additional N.

Results and Discussion

In 2002, corn grain yield and ear leaf greenness were responsive to applied N (Table 1). The Minolta SPAD meter readings increased up to approximately 80 lb N/acre for each rotation. Calculated economic N rates for the C-S rotation was 46 lb N/acre and 100 lb N/acre for C-C. Soybean yield in the C-S rotation averaged 33 bushels/acre in 2002.

The C-C rotation in 2001 and 2002 (when compared with the C-S rotation) required more N fertilizer and produced considerably less corn grain yield.

This study will continue in the future, and the best value will occur after the accumulation of multiple years of data. The results presented in this report are for the first three years and therefore are not meant to represent N recommendations. They do, however, represent responses for the specific years and rotation.

Acknowledgments

Appreciation is extended to David Haden, Northwest Farm superintendent, and his staff for their assistance with this study.

Table 1. Corn ear leaf greenness (Minolta SPAD reading at the R1 growth stage) and corn grain yield as influenced by N fertilizer rate, Northwest Research Farm, 2002.

Year	N rate lb N/acre	C-S				C-C			
		SPAD	YIELD	Econ. N yield	Econ. N rate	SPAD	YIELD	Econ. N yield	Econ. N rate
			----- bu/acre -----		lb N/acre		----- bu/acre -----		lb N/acre
1999				---	---			---	---
	0	---	---			---	---		
	40	---	---			---	---		
	80	---	---			---	---		
	120	---	---			---	---		
	160	---	---			---	---		
	200	---	---			---	---		
	240	---	---			---	---		
2000				---	---			135	97
	0	---	---			49	114		
	40	---	---			51	133		
	80	---	---			53	125		
	120	---	---			52	143		
	160	---	---			52	136		
	200	---	---			52	137		
	240	---	---			51	140		
2001				144	109			120	101
	0	42	108			29	55		
	40	51	120			43	86		
	80	55	143			51	124		
	120	53	149			49	121		
	160	57	144			51	125		
	200	57	144			48	115		
	240	55	142			51	118		
2002				117	46			91	100
	0	46	95			37	59		
	40	49	117			43	78		
	80	51	112			46	87		
	120	51	115			47	88		
	160	52	124			47	94		
	200	52	118			46	91		
	240	52	120			45	95		

Economic N calculated at a 10:1 corn:N price ratio.
Yield at Economic N calculated from the fitted response equation.